Postcoital penile washing and the risk of HIV acquisition in uncircumcised men

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Background: Postcoital genital washing by uncircumcised men may affect the risk of male HIV acquisition.

Method: We assessed the association between self-reported washing after sex in 2976 initially HIV-negative, uncircumcised men enrolled in a prospective cohort study in Rakai, Uganda.

Results: Data from the 2976 participants who reported sexual intercourse in the past 12 months contributed 4290 visits, with 7316.6 person-years of observation during the 2-year follow-up. The overall HIV-incidence was 1.28/100 person-years 95%CI (1.04–1.57). About 91.0% of men reported washing their penis after sex, and their HIV incidence was 1.34/100 person-years (95%CI 1.08–1.66), compared with an incidence of 0.62/100 person-years (95%CI 0.17–1.60) in men who did not wash their penis after intercourse. Using Poisson multivariable regression, the adjusted incidence rate ratio of HIV acquisition associated with postcoital washing was 1.94 (95%CI 0.71–5.29).

Conclusion: Postcoital penile washing, as practiced in this rural African population does not afford protection from HIV acquisition among uncircumcised men, and may increase risk.

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Keywords: HIV incidence, postcoital washing, Rakai, Uganda, uncircumcised men

Introduction

Three randomized trials, including one conducted in Rakai, Uganda, have shown that male circumcision is efficacious for HIV prevention in men [1–3], and WHO has recommended that circumcision be promoted as a component of HIV prevention programs [4]. However, there are potential challenges to circumcision scale up, and alternatives to male circumcision have been suggested, including improved penile hygiene [5] or

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use of a postcoital penile microbicide wipe to remove potentially infectious vaginal secretions from the sub-preputial space in uncircumcised men [6]. Although postcoital washing is common in Africa, there have been no prospective studies to assess the impact of these practices on HIV-acquisition [7,8]. Postcoital washing is associated with reduced genital ulcer disease (GUD) [9,10], and lower prevalence of HIV-infection [7]. Additionally, sub-preputial wetness has been associated with prevalent HIV infection [11]. However, vaginal cleansing is associated with increased HIV-acquisition in women [12,13].

In an analysis of data from the randomized male circumcision trial in Rakai, we previously reported that postcoital washing was associated with a nonsignificantly increased risk of HIV acquisition among uncircumcised controls, especially if they washed the penis shortly after intercourse [14]. To further explore these associations, we assessed the association between postcoital penile washing and the risk of HIV acquisition among uncircumcised men enrolled in Rakai Community Cohort Study.

Methods

The Rakai Community Cohort Study maintains approximately annual surveillance in a population of ~14 000 persons aged 15–49 years resident in 50 communities in rural Rakai District, Uganda. Eligible participants are identified via a household census and provide written informed consent for participation at enrollment and at each follow-up visit. This is an open cohort, which enrolled newly eligible persons. Information on sociodemographic characteristics, sexual risk behaviors, and health status are obtained by interview and venous blood is collected for HIV and sexually transmitted infection testing. HIV status was assessed by two enzyme immunoassays: Vironostika HIV-1 (Organon Teknika, Charlotte, North Carolina, USA) and Welcozyme HIV 1 + 2 (Murex Diagnostics, Dartford, UK). Discordant results and all seroconversions were confirmed by western blot (Cambridge Biotech HIV-1 western blot; Caltype Biomedical Corp, Rockville, Maryland, USA).

At enrolment and follow-up visits sexually active men were asked about genital hygiene practices which included washing after sexual intercourse with each sexual partner over the 12 months preceding interview. Materials used for washing were not fully captured but all included water. In this study, a total of 2976 HIV-negative uncircumcised men enrolled in Rakai Community Cohort Study who reported sexual activity at three survey rounds conducted from August 2006 to April 2008, July 2008 to December 2009, and January 2010 to June 2011, respectively, were assessed to determine HIV-incidence. We excluded 128 intersurvey intervals in which men reported no sex in the past 12 months.

Table 1. Baseline characteristics of participants.

Characteristics	Number of participants (2976)	Percentage (100.0)
Age in years		
15–19	381	12.8
20–29	1168	39.3
30–49	1427	48.0
Education (schooling)[a]		
No	91	3.2
Yes	2761	96.8
Marital status		
Not married	948	31.9
Married-monogamous	1782	59.9
Married-polygamous	246	8.3
Nonmarital relationship		
No	1911	64.2
Yes	1065	35.8
Sex partners in past 12 months		
One	1721	57.9
2+	1254	42.2
Penile washing after sex		
No washing	268	9.0
Washed	2708	91.0
Condom use		
No	2347	78.9
Yes	629	21.1
HCT receipt in past 12 months		
No	2198	73.9
Yes	778	26.1
Self-reported GUD past 6 months		
No GUD	2544	85.5
GUD	432	14.5
Sexual partner likely to be HIV infected		
Partner not likely	1238	41.6
Partner likely	1738	58.4

GUD, genital ulcer disease.
[a]Data not fully available for all men.

The study was approved by four institutional review boards: the Science and Ethics Committee of the Uganda Virus Research Institute (Entebbe, Uganda), the Uganda National Council for Science and Technology, the Institution Review Board at Johns Hopkins University, Bloomberg School of Public Health (Baltimore, Maryland, USA), and the Western Institutional Review Board (Olympia, Washington, USA).

Statistical analyses

We estimated HIV incidence rates per 100 person-years assuming that infection occurred at the midpoint between the last negative and first positive HIV test. We assessed HIV incidence during intersurvey intervals in which sexually active men reported they did or did not practice postcoital washing of their penis.

A generalized linear model with a Poisson distribution, log link function, and an offset of person-years was used to estimate unadjusted and adjusted incidence rate ratios (IRR) and 95% confidence intervals (95% CI) of HIV

Table 2. HIV incidence, unadjusted, and adjusted incidence rate ratios in uncircumcised men.

	Total observations, *N*	Incident cases/person-years	Incidence per 100 person-years	Unadjusted IRR (95% CI)	Adjusted IRR (95% CI)	*P* value
Overall	4290	94/7316.6	1.28			
Age group						
15–19	429	8/755.5	1.10	1.0	1.0	
20–29	1630	45/2788.2	1.61	1.52 (0.72–3.24)	1.73 (0.77–3.87)	0.184
30–49	2231	41/3772.9	1.09	1.03 (0.48–2.19)	1.47 (0.59–3.65)	0.410
Education						
No	120	3/207.5	1.45	1.0		
Yes	3782	86/6489.3	1.33	0.92 (0.29–2.92)		
Marital status						
Not married	1191	38/2065.4	1.84	1.0	1.0	
Married monogamous	2716	43/4602.4	0.93	0.51 (0.33–0.79)	0.63 (0.36–1.09)	0.099
Married polygamous	382	13/647.4	2.01	1.09 (0.58–2.05)	1.20 (0.49–2.91)	0.688
Current nonmarital relationship						
No	2849	42/4875.1	0.84	1.0	1.0	
Yes	1440	52/2439.8	2.13	*2.47 (1.65–3.72)*[b]	*2.16 (1.22–2.36)*	0.008
Sex partners in past 12 months						
One	2485	36/4265.7	0.84	1.0	1.0	
2+	1804	58/3049.2	1.90	*2.25 (1.49–3.42)*[c]	1.37 (0.80–2.36)	0.251
Postcoital penile washing						
No washing	369	4/641.9	0.62	1.0	1.0	
Washed	3920	90/6673.0	1.35	2.16 (0.79–5.90)	1.94 (0.71–5.29)	0.195
Genital ulcer disease in past 6 months[a]						
No	3709	73/6319.3	1.16	1.0	1.0	
Yes	580	21/995.6	2.11	*1.83 (1.12–2.97)*[d]	1.53 (0.93–2.51)	0.096
Condom use						
No	3449	71/5877.9	1.21	1.0	1.0	
Yes	840	23/1437.0	1.60	1.33 (0.83–2.12)	0.66 (0.38–1.16)	0.150
HCT receipt in past 12 months						
No	3041	75/5195.9	1.44	1.0	1.0	
Yes	1248	19/2119.0	0.90	0.62 (0.38–1.03)	0.65 (0.40–1.08)	0.094
Sexual partner likely to be HIV infected						
Partner not likely	1783	27/3058.4	0.88	1.0	1.0	
Partner likely	2506	67/4256.5	1.57	*1.78 (1.14–2.79)*[e]	1.34 (0.82–2.20)	0.238

[a]Variable was only available during follow-up visit.
[b]$P \leq 0.001$.
[c]$P < 0.001$.
[d]$P = 0.016$.
[e]$P = 0.011$.

acquisition. Because men could have multiple follow-up intervals, Huber–White sandwich robust standard errors were estimated to account for nonindependence between repeated observations. Only men reporting sexual intercourse in the past 12 months prior to the survey were included in the final analysis. Model covariates included fixed enrolment characteristics (age and marital status), and interval-specific time-varying covariates, including sexual risk behaviors and self-reported GUD symptoms as potential confounders. Covariates significant at $P < 0.15$ in the univariate analyses, or those having unadjusted IRR greater than 2.0 or less than 0.5 were included in the multivariable analyses. Statistical significance was determined by the Wald test or the log likelihood ratio text. All analyses used STATA version 9.2.

Results

Table 1 shows the baseline characteristics of the 2976 HIV-negative uncircumcised participants, enrolled and interviewed at rounds 12 and 13. At enrollment 68.1% were married, 35.8% reported a nonmarital relationship, 14.5% reported GUD symptoms, 58.4% reported that their sexual partners where likely to be HIV-infected, and 26.1% had received HIV counseling and testing in the past 12 months. Postcoital washing was common (91.0%).

Table 2 shows the number of observations contributed by the participants, HIV incidence and the crude and AdjIRRs of HIV acquisition. A total of 4290 observations were accrued. At 3920 visits (91.3%) men reported postcoital washing, and at 369 visits (8.7%) men reported no penile washing after sex. During follow-up, a total of 7316.6 persons-years were accrued (median = 1.62 years (interquartile range 1.58–1.73). The overall HIV-incidence was 1.28/100 person-years (95%CI 1.04–1.57). HIV-incidence was higher in men who reported postcoital washing 1.35/100 person-years (95%CI 1.08–1.66) compared to those not reporting washing 0.62/100 person-years (95%CI 0.17–1.60), but this difference was not statistically significant [adjusted incidence rate ratio (AdjIRR) = 1.94, 95%CI 0.71–5.29]. HIV incidence was increased among men reporting GUD in the prior

6 months 2.11/100 person-years (95%CI 1.131–3.22) compared to 1.16/100 person-years in men without this symptom, but this difference was not statistically significant after adjustment (AdjIRR = 1.53, 95%CI 0.93–2.51). The interaction between postcoital washing and GUD was not statistically significant and was dropped from the final model. Men with current nonmarital relationships had significantly higher HIV incidence than those without such relationships (AdjIRR = 2.16, 95%CI 1.22–2.36).

Discussion

The prospective study suggests that washing the penis following intercourse is not protective against HIV acquisition. This is consistent with our prior finding that HIV incidence was higher among men who washed their penis with water compared with men who used a dry cloth [14]. Taken together, these observations suggest that postcoital washing with water may increase the likelihood of HIV infection.

These findings were contrary to our expectations. We anticipated that uncircumcised men who did not wash their penis after intercourse might be at increased risk of HIV acquisition because of longer HIV survival in the moist subpreputial space. However, it is possible that HIV-infected vaginal secretions suspended in liquid form as a consequence of washing may facilitate mucosal penetration by the virus [15,16]. It is also postulated that the acid pH of vaginal secretions may impair HIV survival [17], so use of water with a neutral pH could facilitate viral survival. Therefore, if uncircumcised men use water to cleanse the penis shortly after intercourse, they may retain suspended infected vaginal secretions in the subpreputial space enhancing the risk of HIV infection. Conversely, if men do not wash their penis after sex or delay washing, vaginal secretions may become desiccated and less infectious.

There are limitations to this observational study. Self-reported information on postcoital practices may be unreliable and we have no means of validating men's responses to these questions. We did not obtain information on postcoital cleansing practices from female sexual partners. There is a possibility of residual confounding if higher risk men were more likely to wash after sex with a riskier partner, but we adjusted for nonmarital relationships and the men's perception of their partner's likely infection status in the multivariate model. The study had limited power to detect an effect of washing on HIV acquisition because of the small number of men in the referent group who reported that they did not wash their penis after intercourse.

There is a need for more investigation of viral survival in subpreputial secretions. Nevertheless, we conclude that postcoital penile washing, as practiced in this rural African population does not afford protection from male HIV acquisition and may increase risk.

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Conflicts of interest

There are no conflicts of interest.

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